PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES

APPLICANTS: Raimund RATZI ET AL. - 2 PCT

SERIAL NO.: 10/529,294 EXAMINER: W. ZHU

FILED: MARCH 25, 2005 GROUP: 1742

TITLE: METHOD FOR PRODUCING A MOULDED BODY FROM SINTERED STEEL

BRIEF ON APPEAL

MAIL STOP APPEAL BRIEF
Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, VA 2313-1450

Dear Sir:

In accordance with the provisions of 37 C.F.R. 41.37(c), the following items under appropriate headings are provided for in this appeal from the final rejection of claims 1-3:

REAL PARTY IN INTEREST

The real party in interest is the assignee, Miba Sinter Austria GmbH.

RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellant, the Appellant's legal representative, or assignee which are related to or may directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

Claims 1-3 are in the application. Claims 1-3 were finally rejected in an Office Action dated June 18, 2007. No claims have been allowed. The appealed claims are 1-3.

STATUS OF AMENDMENTS

The Preliminary Amendment filed on March 25, 2005 has been entered. No further amendments were made to the claims. The Examiner has indicated in the September 25, 2007 Advisory Action that the claims remain rejected over the prior art to Marshal et al. and Nishida et al.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention as set forth in independent claim 1 provides a method for producing a molded body made of sintered steel, with a sintering powder on the basis of iron being mixed with a master alloy powder containing nickel, boron and iron. The powder mixture is pressed into a formed body before the formed body is sintered under the conditions of a liquid-phase sintering with a volume share of liquid phase up to 15%. The boron content of the powder mixture is between 0.03% and 0.2% by weight at a boron share of the master alloy powder of less than 10% by weight. The weight ratio between the nickel and the boron share of the powder mixture exceeds 5 and the master alloy powder has an average particle size of between 10 and 90 μm.

According to claim 2, the boron content of the powder mixture lies between 0.10% and 0.15% by weight.

According to claim 3, the powder mixture has a carbon content of between 0.15% and 0.8% by weight.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-3 have been rejected under 35 USC § 103(a) as unpatentable over Marshall et al. (GB 975322) in view of Nishida et al. (Effect of B on the Densification and the Mechanical Properties of Sintered Iron Powder Compacts, J. Japan Inst. Metals, Vol. 54, No. 10 (1990), pp. 1147-1153).

The Examiner has taken the position that Marshall et al. discloses a method for producing a ferrous alloy component from a powder mixture comprising:

mixing thoroughly the powders by weight of Ni (0.5-6%), Cu (0.5-5%), Mn (0.5-4%), B (0.01-0.4%), C (graphite, 0.05-1.5%) and Fe (balance) (lines 30-39);

compacting the powder mixture in a die (lines 75-77); and

sintering the compact in a non-oxidizing atmosphere at a temperature between 1100 °C and 1400° C(lines 77-81) (i.e.

during sintering boron combines with other constituents to form a liquid (eutectic) phase).

The Examiner asserts that Marshall et al. further discloses that Ni may be added as a powdered alloy with one or more of the other metals present (lines 29-32) (i.e. as a master alloy) with an eventual particle size of about 50 micrometers (lines 42-45), which is within the claimed master alloy average particle size of 10-90 micrometers in the instant claim 1.

The Examiner states that (1) the B content range of the powder mixture of Marshall et al. overlaps the claimed ranges of 0.03-0.2 wt% and 0.1-0.15 wt% in the instant claims 1 and 2; (2) the weight ratio between the Ni and the B shares of the powder mixture of Marshall et al. exceeds 5 as claimed in the instant claim 1; and (3) the carbon content range of the powder mixture of Marshall et al. overlaps the claimed range of 0.15-0.8 wt% in the instant claim 3. The Examiner further asserts that the overlapping ranges establish a prima facie case of obviousness, MPEP 2144.05.

The Examiner concedes that Marshall et al. does not teach a master alloy powder containing Ni, B and Fe as in the instant claim 1.

The Examiner states that Nishida et al. teaches using a master alloy powder made of Fe, Ni and B with the B share of the master alloy powder of 10%, which is the upper limit of the claimed B share in the instant claim 1. The Examiner claims that it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a master alloy powder containing Fe, Ni and B of Nishida et al. in the process of Marshall et al. in order to increase the volume fraction of the eutectic liquid phase and increase the sintering strength as disclosed by Nishida et al.

The Examiner concedes that Marshall et al. does not disclose the volume share of the liquid phase during the liquid sintering as in the instant claim 1. However, the Examiner asserts that it has been well held where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical process, a prima facie case of either anticipation or obviousness has been established. In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977), MPEP 2112.01 [R-3] I. In the Examiner's view, (1) the composition of the compact and the sintering conditions of Marshall et al. are identical or substantially identical to those of the instant disclosure, therefore, a prima facie case of obviousness exists; and (2) the same volume share of the liquid phase as claimed would be expected in the process of Marshall et al. in view of Nishida et al.

The grounds to be reviewed are whether the Examiner's rejection of claims 1-3 is correct or should be overturned.

ARGUMENT

Rejection under 35 U.S.C. 103(a) as Unpatentable over Marshall et al. in view of Nishida et al.

Claim 1

Marshall et al. (GB 975 322) describes a sintered material based on iron that has nickel and boron in a wide range of amounts. Marshall et al. explains (page 1, lines 20 to 29) that it is advantageous not to use pre-alloyed powders. In lines 40 to 42, it states that nickel can be used as a pre-alloyed powder with one or two of the other (alloy) metals indicated, and this also corresponds to claim 3 of Marshall as cited by the Examiner. Since boron is not included in the group of metals in the periodic system, a pre-alloyed powder that contains nickel and boron is not disclosed by Marshall et al. This circumstance is also evident from the explanations by Marshall et al. with regard to the boron content, when it is explained on page 1, lines 55 and 56, that boron can be added not only in amorphous form, but also as ferroboron or as metallic borate.

In the present invention, it comes down decisively to the fact that a prealloy powder is used that contains nickel, boron, and iron, in which the boron content of the prealloy powder must

be less than 10% by weight and the weight ratio of nickel to boron must be greater than 5. Marshall et al. discloses that nickel can be prealloyed with another metal but a prealloy of iron, nickel, and boron is excluded. This shows that Marshall et al. in fact precludes a pre-alloyed powder of nickel, boron, and iron as alloy elements.

Nishida et al. (Effect of B on the Densification and the Mechanical Properties of Sintered Iron Powder Compacts, J. Japan Inst. Metals, Vol. 54, No. 10 (1990), pp. 1147-1153) is considered explicitly in the introduction to the specification of the invention. Nishida et al. shows that adding boron in the form of a prealloyed powder of iron, nickel, and boron, produces special benefits with respect to tensile strength, with the effects of the prealloy powder on the mechanical properties of sintered steel being examined with a proportion of the prealloy powder between 3 and 7 wt.% of the total mixture. It was found that a higher density of sintered steel could be achieved with increasing proportion of the prealloy powder at a given sintering temperature, as seen from Fig. 7 of Nishida et al. Furthermore, Fig. 6 of Nishida et al. shows that the proportion of liquid phase rises with increasing proportion of the prealloy powder. Since a liquid phase proportion of at least 9 vol.% has to be achieved for adequate density of the sintered steel, this means a proportion of prealloy powder that is greater than 3 wt.%.

Nishida et al cannot anticipate the invention because a boron content in the total mixture of 0.3 to 0.7% results from a proportion of 3 to 7 wt.% prealloy powder with the given composition of the prealloy powder, which is distinctly higher than the upper limit of 0.2 wt.-% indicated in claim 1.

The Examiner states that it would have been obvious to one skilled in the art to use a prealloyed powder according to Nishida in Marshall et al. to arrive at the invention. However, Nishida et al. necessarily assumes a proportion of the prealloyed powder of at least 3 wt.% to produce the targeted tensile strength. It can therefore not be obvious in any way from Nishida et al to use a smaller proportion of the prealloyed powder of iron, nickel, and boron, because the tensile strength then obviously cannot be achieved.

If one of skill in the art were seeking to increase strength and impact resistance, they might look to the teaching of Nishida et al., but then the values of Marshall et al. would have to be abandoned, because Nishida et al. shows that the tensile strength can be significantly increased only by means of a pre-alloyed powder of Fe-Ni-B, and then only if the boron content is selected to be greater than 0.3 wt.-%. It is surprising that despite an appropriately high tensile strength, impact resistance can be decisively improved if the boron content of the powder mixture is between 0.03 and 0.2 wt.% when the boron fraction of the prealloy

powder is below 10 wt.%. Coalescence of local boride regions is sufficiently hindered by the limitations specified in claim 1 to be able to suppress the development of a continuous boride network. This effect is disclosed neither by Marshall et al. nor by Nishida et al., and also cannot be shown by a combination of these citations, inasmuch as a rational interpretation of Nishida et al necessarily has to lead to raising the boron fraction from Marshall et al. beyond the limits pursuant to the invention.

A person skilled in the art is given no suggestion in Marshall et al. to lower the boron content in Nishida et al., which is in contradiction to the teaching of Nishida et al. This is because Nishida et al relates the special effect of the pre-alloyed Fe-Ni-B powder in a minimum proportion in this powder, which presupposes a corresponding minimum content of boron. The greater boron content is what specifically opposes an improvement in the impact resistance of the sintered steel. Marshall et al. describes a boron content between 0.01 to 0.4 wt.-%, but a person skilled in the art is by no means moved to lower the boron content in Nishida et al to the range claimed in the present invention, because Nishida et al unmistakably shows that the liquid phase during sintering required for the desired tensile strength cannot be achieved with such a low boron content. Therefore, Nishida teaches away from the invention claimed in claims 1-3 of the present invention.

In summary, Marshall et al. and Nishida et al. cannot be combined, to provide a pre-alloyed Fe-Ni-B powder according to Nishida, but with clearly lower boron proportions as disclosed in some of the range Marshall et al. This is because Nishida et al. shows that the higher boron content is what is important, so that a person skilled in the art can only conclude from Marshall et al. and Nishida et al. that if the boron content is reduced in a range as that covered by Marshall et al, the metallic properties of the sintered steel will significantly decrease, particularly with regard to the tensile strength. A person skilled in the art therefore has no reason to lower the boron content in accordance with the invention, because on the basis of the teachings of Marshall et al and Nishida et al, he/she can only presume that the metallic properties of the sintered metal can only worsen with a reduction in the boron content when using a pre-alloyed powder of iron, nickel, and boron. Therefore, it must be considered surprising and inventive that not only can the tensile strength be increased by reducing the boron content, despite the use of a pre-alloyed powder of iron, nickel, and boron, but also the impact resistance of the sintered steel can be significantly improved. This is not taught or suggested by either Nishida or Marshall.

Accordingly, Applicant respectfully requests that the Board overturn the Examiner's rejection and instruct the Examiner to allow claim 1.

Claim 2

Applicant hereby incorporates the arguments in support of overturning the Examiner's rejection in claim 1 because claim 2 directly depends from claim 1.

Accordingly, Applicant respectfully requests that the Board overturn the Examiner's rejection and instruct the Examiner to allow claim 2.

Claim 3

Applicant hereby incorporates the arguments in support of overturning the Examiner's rejection in claim 1 because claim 3 directly depends from claim 1.

Accordingly, Applicant respectfully requests that the Board overturn the Examiner's rejection and instruct the Examiner to allow claim 3.

Respectfully submitted,
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<u>Enclosures</u>: Claims Appendix, Evidence Appendix, Related Proceedings Appendix, Check in the amount of $510.00

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Assistant Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on November 28, 2007.

Amy Klein

Amy Klein

APPENDIX A

CLAIMS APPENDIX

Claims 1-3

Claim 1. A method for producing a molded body made of sintered steel, with a sintering powder on the basis of iron being mixed with a master alloy powder containing nickel, boron and iron, and with the powder mixture being pressed into a formed body before the formed body is sintered under the conditions of a liquid-phase sintering with a volume share of liquid phase up to 15%, wherein the boron content of the powder mixture is between 0.03% and 0.2% by weight at a boron share of the master alloy powder of less than 10% by weight, that the weight ratio between the nickel and the boron share of the powder mixture exceeds 5 and that the master alloy powder has an average particle size of between 10 and 90 µm.

Claim 2. A method according to claim 1, wherein the boron content of the powder mixture lies between 0.10% and 0.15% by weight.

Claim 3. A method according to claim 1, wherein the powder mixture has a carbon content of between 0.15% and 0.8% by weight.

APPENDIX B

Appendix B: Evidence Presented

Applicant is not submitting any additional evidence with this Appeal Brief.

APPENDIX C

RELATED APPEALS AND PROCEEDINGS:

None.